DETAILED ACTION

1. Pending claims for reconsideration are claims 1-13.

Allowable Subject Matter

2. Claims **9-13** are allowed.

3. The following is an examiner's statement of reasons for allowance:

Regarding claim 9-10, the closest prior arts issued to Zavriyev(Patent No.: US 7,606,731) in view of Bennet(patent Number:5,515,438) fail to teach or suggest "performing a fine timing adjustment by incrementally scanning a relatively narrow modulator activation signal over a timing interval centered about the coarse timing value determined in; to establish a fine timing value that corresponds to a change in an amount of non-quantum signals detected due to a change in modulation of the non-quantum signal." Zavriyev and Bennet combined simply offer a two way quantum key distribution system and active compensation with non-orthogonal quantum key distribution method which uses a beam splitter to split off a small fraction of the modulated signal for minor measurement where the major measurement is performed by detecting two pulses S and R in two separate square law detectors and recording the result of component intensity integrated over the pulse duration. Regarding claims 11-13, the closest prior arts issued to Merolla in view of Bennet fails to teach or suggest having first and second optically linked QKD stations a method of establishing

timing of first and second modulator activation signals VI and V2 and for a first modulator MB in the first QKD station Bob and a second modulator MA in the second QKD station Alice respectively, the method comprising: setting the second modulator MA to a fixed modulation setting the first modulator MB to a fixed modulation varying the first activation signal timing in a coarse increment ΔT1 about an initial timing T10 to establish a course timing T1C of the first activation signal by observing a change in detector counts of exchanged non-quantum pulses; varying the first activation signal timing by reduced timing intervals $\Delta TR<\Delta T1$ about the coarse timing T1C to establish a fine timing T1F of the first activation signal by observing a change in detector counts of exchanged non-quantum pulses varying the second activation signal timing by coarse timing intervals ΔT2 about an initial timing T20 to establish a course timing T2C of the second activation signal by observing a change in detector counts of exchanged non- quantum pulses varying the second activation signal timing in reduced timing increments $\Delta T2R<\Delta T2$ about the course timing T2C to establish a fine timing T2F of the second activation signal by observing a change in detector counts of exchanged non-quantum pulses setting the first activation signal V1 to a relatively large initial width W1C" ; "setting the first activation signal to a reduced width W1R < W1C"; setting the second activation signal V2 to a relatively large initial width W2C; setting the second activation signal to reduced width W2R<W2C." Merolla and Bennet combined simply offer an integrated quantum key distribution system using single sideband detection with a quantum key distribution system using non-orthogonal macroscopic signals where the

intensity/width can be relatively large and at the receiving end can be reduced via a beam reducer.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Response to Arguments

4. Applicant's arguments filed 02/19/2010 have been fully considered but they are not persuasive.

In the remarks, applicant argues in substance:

a. ***That-*** Claims 1, 9 and 11 are tied to a particular machine--namely, a QKD system. The various acts in the claims define a way of establishing timing of first and second modulators in the QKD system (i.e., the "machine) using "modulator activation signals," "exchanged non-quantum signals" and "detector counts." The established modulator timing is a physical result based on the operation of components of the QKD "machine"(pg.4).
In response to applicant's argument- The Rejection of **claim 1, 9, and 11** under 35 USC 101 as allegedly not falling within one of the four

statutory categories of invention have been **withdrawn in light of applicants arguments.**

b. ***That-*** Zavriyev does not include any disclosure or information relating to establishing the timing for the first and second modulators, including setting the first and second modulators to a fixed modulation and incrementally scanning modulator activation signals while transmitting non-quantum (optical) signals in the process of establishing modulator timing.

In response to applicants argument- Zavriyev discloses establishing timing for a first and second modulator to a fixed modulation. Two Quantum signals QS' and QS" encounter a PM coupler which splits each signal in two creating for quantum signals where the two signals of QS' pass through phase modulator PMB1. The phase modulator is activated to impart the signal into a random phase which is accomplished by via a timed gating pulse GPB1 from the controller as disclosed in Col.6 lines 31-Col.7/lines 13 also illustrated in figure 1. Zavriyev further discloses in Fig.4 a control signal CS which precedes the quantum pulse where it is used to trigger the timing/synchronization scheme between Alice and bob controller via a channel link [Col.7/lines 43-51]. Zavriyev does not explicitly disclose the feature of incrementally scanning modulator activation signals while transmitting non-quantum (optical) signals in the process of establishing modulator timing. Bennet was introduced and disclosed a

non-orthogonal quantum key distribution method using a beam splitter to split a small fraction of the modulated signal for minor measurement where the major measurement is performed by detecting two pulses S and R in two separate square law detectors and recording the result of component intensity, integrated over the pulse duration as disclosed in Bennet [Col.6/lines 4-20] and Bennet Figure.1. it is the combination of Zavriyev and Bennet that teaches the claimed invention, not Zavriyev or Bennet alone (s*ee 103 rejection below for claim 1).*

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Patent No.: US 7,606,371 B2 to Zavriyev et al (hereafter referenced as Zavriyev) in view of Patent Number: 5,515,438 to Bennett et al (hereafter referenced as Bennett).

Regarding **claim 1**, Zavriyev discloses "A method of establishing timing for first and second modulators in a quantum key distribution (QKD) system"***(see phase modules [Fig.1/items 104A and 104B] also see phase modulators PMB1 and timed gating pulse GPB1 [Col.7/lines 1-10])***, "comprising: setting the second

modulator to a fixed modulation"***(a fixed relationship/modulation is maintained between modulated signals [abstract])***; "setting the first modulator to a fixed modulation" ***(a fixed relationship/modulation is maintained between modulated signals [abstract]),*** Zavriyev does not explicitly disclose "incrementally scanning an activation signal for the first modulator over a range of timing values to determine the first modulator activation signal timing based on a change in detector counts of exchanged non-quantum signals; and incrementally scanning an activation signal for the second modulator over a range of timing values to determine the second modulator activation signal timing based on a change in detector counts of exchanged non-quantum signals." However, Bennett in an analogous art discloses a non-orthogonal quantum key distribution method which uses a beam splitter to split off a small fraction of the modulated signal for minor measurement where the major measurement is performed by detecting two pulses S and R in two separate square -law detectors and recording the result of component intensity, integrated over the pulse duration ***(Bennett [Col.6/ lines4-20] also see Bennett [Fig.1]).***

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Zavriyev's two-way Quantum Key Distribution system and active compensation with a non-orthogonal quantum key distribution method which uses a beam splitter to split off a small fraction of the modulated signal for minor measurement where the major measurement is performed by detecting two pulses S and R in two separate square -law detectors and recording the result of component intensity , integrated over the

pulse duration as suggested by Bennett ***(Bennett[Col.6/ lines4-20] also see Bennet[Fig.1]).***

Regarding **claim 2** in view of claim 1, the references combined disclose "wherein the QKD system is a two-way system" ***(two-way actively stabilized QKD system Zavriyev [abstract]), "***and the first and second modulators are phase modulators" ***(Alice phase modulator Zavriyev [see Fig.1/PMA] and Bob phase modulator Zavriyev [See Fig.1/PMB1).***

Regarding **claim 3** in view of claim 2, the references combined disclose "wherein the first modulator is in a first QKD station (Bob) that generates the non-quantum signals, the second modulator is in a reflective QKD station (Alice) that reflects the non-quantum signals back to the first QKD station"***(Alice phase modulator Zavriyev[see Fig.1/PMA] and Bob phase modulator Zavriyev[See Fig.1/PMB1)***, "and wherein the method further includes: discerning between two timing intervals associated with non-quantum signals entering and leaving the first QKD station to ensure that only non-quantum or quantum signals entering the first QKD station are modulated by the first modulator"***(Zavriyev[Fig.4] discloses timing of quantum signal(QSI) and control signal(CS) Zavriyev[Col.3/line42-45]).***

Regarding **claim 4** in view of claim 1, the references combined disclose "wherein the activation signals for the first and second modulators provide respective modulations that result in a maximum change in detector counts when the exchanged transmitted non-quantum signals experience a change in modulation"***(Zavriyev[Fig.5/item 112] discloses the detection stage for the***

first and second signals of first and second modulators Zavriyev[Col.7/line54-63], non quantum signal or the control signal follows the same path as the quantum signal during the detection stage Zavriyev[Col.7/line 14-22]),

Regarding **claim 5** in view of claim 1, the references combined disclose "wherein the activation signals for the first and second modulators provide respective modulations that are not basis modulations associated with establishing a quantum key", ***i.e. activation signals provide modulation not associated with the quantum signal(the control signal follows the same path as the quantum signal and is modulated and divided into two signals in the same manner as the quantum signal during the detection stage Zavriyev[Col.7/line 19-23]),***

Regarding **claim 6** in view of claim 1, the references combined disclose "wherein the detector counts occur in first and second detectors, which are arranged so that constructively interfered non-quantum signals are detected in the first detector and destructively interfered non-quantum signals are detected in the second detector" ***(Zavriyev[Fig.5/item 112] discloses the detection stage for the first and second signals of first and second modulators Zavriyev[Col.7/line54-63], non quantum signal or the control signal follows the same path as the quantum signal during the detection stage Zavriyev[Col.7/line 14-22]),***

Regarding **claim 7** in view of claim 1, the references combined disclose "including for each modulator: establishing a coarse timing interval"

(Zavriyev[Fig.3a-3b] disclose I vs. time intervals also see Zavriyev[Col.3/lines38-41]); "dividing up the coarse timing interval into a number of sub-intervals", ***i.e. timing signal is split into multiple signals(see gating pulses GPA and GPB (Zavriyev[Col.8/lines25-32])***; "and incrementally scanning the sub-intervals to establish a more accurate modulator timing"***(central interference pulse can be detected from quantum signal Zavriyev[Col.8/line25-32]).***

Regarding **claim 8** in view of claim 7, the references combined disclose "including reducing a width of the activation signal for each modulator" ***(Variable attenuator can attenuate the signals Zavriyev [Col.5/line16-22] also see Fig.2A).***

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will

the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHAEL ANDERSON whose telephone number is (571)270-5159. The examiner can normally be reached on Monday-Friday 8am til 5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kieu-oanh(Krista) T. Bui can be reached on (571)272-7291. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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